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INTELLIGENCE MEMORANDUM NO. 207 1 September 1949

SUBJECT: Strategic Significance of Anti-Friction Bearings Moving to Eastern Europe.

SUMMARY OF CONCLUSIONS.

The Soviet Union is now importing anti-friction bearings both for internal use and as a stockpiling measure. Although some industrial plants and users of equipment are experiencing acute shortages of certain types of imported bearings, significant quantities of these bearings are being withheld for stockpiling purposes.

Procurement and distribution of anti-friction bearings throughout the Soviet orbit is centrally directed by the Soviet Union.

Soviet-directed imports are for both military and industrial use. The total inventory of industrial equipment within the orbit is predominantly of foreign origin and requires anti-friction bearing replacements from foreign manufacturers. It is probable that this problem is partially met by cannibalization rather than through use of imported bearings. The analysis of inquiries and requirements as stated in intelligence data reviewed by US Government engineers and technicians indicates a predominant import of potentially military end-use anti-friction bearings.

The quantities of anti-friction bearings now sought by the Soviet orbit and probably actually being imported are in excess of reasonable peacetime consumption. Analysis of Soviet imports of anti-friction bearings indicates quantities far in excess of original estimates for 1948 and even more emphasis on imports during the first part of 1949. These imports include not only finished, assembled anti-friction bearing units but also special anti-friction bearing steel (i.e., tubing, bar stock, and coil stock) and parts (retainers, steel balls, rollers, etc.). With Western manufacture increasing production schedules, it is probable that, barring effective economic controls, imports by the Soviet orbit will continue to increase. Sweden, in particular, has already announced a 25 percent increase in manufacturing capacity for which there seems to be no outlet other than the Soviet countries.

While significant quantities of direct shipments are being made to the Soviet orbit by Sweden, Italy, and Switzerland, a very large quantity in

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excess of official trade agreements are being provided by producing countries through transshipments. The most commonly used route for transshipments of US, Italian, Swedish, German, and French manufacturers is through Switzerland and Austria into Czechoslovakia.

Because of the great strategic importance of all anti-friction bearings, it would appear that denial of exports to be effective, would have to be on an all-inclusive basis, rather than on a numbering system, a "precision" classification, or a type classification.

USES AND CHARACTERISTICS OF ANTI-FRICTION BEARINGS

The use of anti-friction bearings underlies every operation of an industrial economy. There is hardly a moving part of metal or solid material which does not revolve, roll, or slide on anti-friction bearings. Although a plain bearing still forms an important part in moving mechanisms, basic motion at high speeds (or even slow motion requiring durable and smooth performance) is dependent on anti-friction (ball, roller, and needle) bearings. In spite of some claims that modern industrialization has been "over-sold" on anti-friction bearings, that criticism is applicable only to types and specifications, and in no way reflects on the basic necessity of using anti-friction bearings of some type throughout an industrial economy.

The use of ball and roller bearings by American manufacturers of machinery did not become general until 1920. It was probably the widespread use and durability of bearings shown in automotive applications that demonstrated their usefulness to the machinery builder and decided the change from plain to anti-friction bearings. In the case of electric motor applications, the first installations were made in steel mills and cement mills, where the life of plain bearings ranged from a few days to a few months. When a plain bearing wore out on a motor, it usually meant that the armature dropped down onto the stator resulting in damage that often required complete rewiring of the motor. The failure of a ball or roller bearing does not create such damage. Other reasons for the widespread adoption of anti-friction bearings are as follows: (a) less power is lost as a result of the lower coefficient of friction; (b) starting resistance is less; (c) ball bearings are shorter than plain bearings and more compact; (d) the danger of heated bearings is eliminated; (e) deflections of a shaft can be compensated for in the bearing design; (f) wear and replacement costs are reduced; and (g) higher speeds can be obtained in operation.

Practically all the machine tools made in the United States whether they are in textile, food processing, automotive, steel mill, or other industries, use anti-friction bearings on all moving shafts. The Soviets, in establishing their designs of machinery and equipment, copies those of the United States. In doing this, they incorporated ball and roller bearings as component parts.

Above and beyond direct capital goods use, many other items of equipment other than capital goods are today totally dependent on anti-friction bearings. Standard factory housekeeping equipment, such as cranes, air compressors, pumps, mechanical and control instrumentation, laboratory devices, and conveyors are designed to use anti-friction bearings. No aircraft, tank, or automotive vehicle can operate without some form of anti-friction bearings. In turn, the development and engineering of moving parts requiring preciseness, durability, and heavy load-carrying strength in modern equipment has been underwritten by the development of high standards in anti-friction bearing production. A modern machine is built to operate only within the tolerances of certain bearing specifications.

One of the primary functions of the use of anti-friction bearings is to increase the life of the mechanzied equipment. Bearings, in turn, with a life expectancy, according to use, of from a few months to three or four years, are now considered a perishable item requiring constant replacement.

The characteristics of bearings render them sensitive and vulnerable to economic controls during peacetime. In time of war, however, since supplies are normally on hand for immediate replacement needs, and since warfare inflicts attrition on the entire economic equipment inventory (thus negating the use of such equipment and its attendant replacement of component parts), bearings, as such, cannot be considered a vulnerable target for control or destruction. Studies of the results of strategic bombing and economic controls during World War II have proved to participating countries (including the USSR) that control of anti-friction bearings must be undertaken before actual war commences and not during the course of the war.

ESTIMATE OF THE BEARINGS SITUATION IN EASTERN EUROPE

A. Requirements.

It is estimated that the total irreducible minimum bearing requirements of the Soviet orbit are approximately 55-65 million units annually. Soviet orbit production is approximately 75 percent of this requirement. However, quantitative figures represent only a small part of the total figure. Qualitative and strategic requirements are the predominant factors in any total review of Eastern Europe requirements.

B. Production.

Although producing approximately 45 million bearings annually (and repairing an additional several million units), the USSR has failed to supply the Satellites with any but a negligible quantity even though equipment of high priority is being manufactured by the Satellites solely for Soviet use. Recognizing the strategic importance of anti-friction bearings, the USSR has given the entire problem very close attention. Intelligence reports clearly indicate that the movement of anti-friction bearings into and within the Soviet orbit has been, and continues to be, directed by the USSR. Although Soviet bearing production has increased, it is believed that the USSR itself is dependent on imported bearings for more than 25 percent of its needs. Overall requirements, however, have been given a low priority in favor of certain sizes for stockpiling purposes.

Czechoslovakian bearing production, which is negligible in comparison with that of any large producing country, has increased somewhat in the last few months. Of the other countries in the Soviet orbit, Sovzone Germany is also producing anti-friction bearings in limited quantities. Czechoslovakia, has not yet been able to produce the steel balls required for their own production of bearings.

ESTIMATE OF THE BEARINGS SITUATION IN WESTERN EUROPE

A. Production.

During the past few months, there has been a definite change from a seller's market to a buyer's market in anti-friction bearings. Western European manufacturers are producing quantities sufficient for domestic needs.

One of the primary producers, SKF Sweden, has reported a new expansion this spring in the capacity of plant facilities which will permit a production increase of over 25 percent of the company's previous production. The company's backlog has been reduced to current demand and the supplying of normal commercial stocks. Other than the need for certain small categories unique to SKF, it is difficult to see the potential market for the expanded Swedish production within Western world markets. Present Swedish production is approximately 21 million bearings per year.

Italian bearing production has now completely recovered from the effects of the war. The only domestic limitation is the supply of anti-friction bearing-steel. Since Italian production was expanded during the war, Italy has a potential capacity much greater than prewar. Current production is estimated at 22 million bearings per year.

German bizone production has also made a rapid recovery. As a result of reparations, and destruction of machinery during the war, the plants at Schweinfurt have been permitted by the Military Government to obtain new equipment and are continuing to modernize plant facilities for a potentially greater output. Although the German plants are not, at present, on a 24 hour working basis, and production is limited by Western Allied controls, the plants can quickly change to three shifts. Bizone production has risen to an estimated 54 million annually.

The Austrian bearing center at Steyr-Daimler-Puch was also significantly expanded during the war and is now producing more than 4 million bearing units annually.

Current bearing production in Switzerland is estimated at 4,400,000 units annually. Swiss bearing manufacturers are operating below capacity and are currently in need of markets. Before the war, Switzerland was the only source of supply for certian types of precision instrument bearings. Therefore, although Swiss bearing production is not large compared to that of other countries, the Swiss supply is of great strategic importance.

France plans to complete the expansion of its bearing industry by 1950-51. Current French production ranges from 21 to 25 million units annually.

The United Kingdom has been a large producer of anti-friction bearings and maintains a large export business. Present production is estimated at 55 million bearings per year.

OFFICIAL AND UNOFFICIAL SHIPMENTS TO THE EAST BY EUROPEAN COUNTRIES

Although reports of bearing exports by Western European producers to Eastern European countries have been shown to be within the quantities expressed in some trade agreements, information from other sources has been confirmed that considerable quantities beyond the trade agreements are being exported.

Sweden - Firm statistics on Swedish exports to Eastern Europe have not been reported, but it is probable that shipments for 1949 will be in excess of the annual trade-agreement provisions. Previous agreements for 1946, 1947, 1948, were unfulfilled and provided for accumulated balances in favor of the USSR, which Sweden was to fulfill in commodities. An estimated 70% of Swedish production is exported. During 1948 the Soviet orbit received about 6,090,000 bearings.

Italy - Although Italian trade commitments to Eastern Europe provide for substantial quantities, there is some evidence that shipments will be in excess of trade agreement provisions. Several reports contain concrete evidence that bearings manufactured in Italy have been routed directly to Switzerland for transshipment to Eastern European countries. Normal export traffic would be through Austria. Quantities passing through Trieste are unknown. Shipments are irregular and usually have no distinguishing marks. They are expected to continue along this route until early 1950, although freight loadings may be increased.

Italian shipments to Eastern Europe during 1948 totalled between three and four million units, before official commitments to Eastern European countries were effectively implemented by trade agreements.

Germany - Bizone reports on transshipment of domestic bearings, and bearings coming through Belgium and Holland have been confirmed. The total extent of this traffic has not been accurately determined. Export-import operators engaged in transshipment are located in Holland, Belgium and Switzerland. A great quantity of reliable reports have been received of specific eye-witness incidents, largely in the nature of disguised shipments and falsification of official papers across the German border both directly to Czechoslovakia and through Switzerland and Austria. The amounts involved are unquestionably in large volume.

Switzerland - Many emigres and opportunists have set up fly-by-night export-import houses in Switzerland for conducting shipment negotiations with Eastern Europe. These same export-import firms are continually soliciting orders from the US and other producing countries, ostensibly for domestic Swiss consumption. In every case where these inquiries have been investigated, and the operators have given end-uses, it has been disclosed that no such inquiry or need

originated with the Swiss consumers, and that the type of bearings reported to be needed by the Swiss consumers were not actually of the type used. In addition to transshipments of bearings of other than Swiss manufacture, many middlemen within Switzerland have created a false market for Swiss-manufactured bearings, which are shipped to Eastern Europe through Austria.

United Kingdom - The exports of bearings from the United Kingdom to the Soviet orbit for 1948 were reported as being approximately 175,000 units, with Czechoslovakia receiving half. The comparatively small total may be a result of the method of classification of "Precision" bearings and possibly does not cover total shipments.

Austria - Austria has played an important part in the transshipment of bearings from the bizone and Switzerland. In Vienna, Czechoslovakian middlemen operating under Omnipol (Czech State Agency) under the direction of Soviet import agencies, have purchased bearings in lots of 100,000 from other Western European countries, sometimes claiming that these exports were to be made to another Western country. The review of some of the specific bearings sought shows that bearings of the specifications desired were not for use in Austria, but were of the heavier type most readily used in ordnance and heavy industry. In addition, there has been a continuing purchase, within Austria, of domestically manufactured bearings for products going to the USSR. Unique among the many cases of this type is an order placed for a relatively light winch requiring a special type of bearing not normally used in winches. In this case an independent source reported that imported winches were being dismantled by the Soviets for the purpose of salvaging the bearings. The type of bearings specified tends to confirm this report.

Benelux - The three countries forming the Benelux Union are extensively engaged in transshipment, but the numerous reports confirming transshipment do not give a clear picture of annual quantities. Confirmation of the traffic in large single shipments, however, parallels the character of Swiss transshipment, inasmuch as importers give false information to manufacturers as to the end-use and destination of the bearings.

Several documents are available giving specific catagories of anti-friction bearings desired by the Soviet Bloc. Regardless of the country of origin of these inquiries, the quantities and character of the bearings are remarkably similar. The specific nature of the information available on these inquiries and purchases leads, ipso facto, to the conclusion that Soviet-orbit purchasing is centrally organized.

In some cases where the evidence concerns only specific lot shipments of relatively small quantities, however, it seems possible that the bearings are for Satellite production of industrial goods and war material destined for the USSR, which goods, in turn, are procured by centralized management.

A notable example of evidence of this indirect use of bearings is disclosed in documents detailing types of bearings required and imported by Czechoslovakia. These bearings are purportedly for use in tanks, and for some war material which is sent on for possible further processing in Poland --the end destination of these goods being the USSR. The nature of this specific traffic is still being investigated.

Detailed reports specifically define Satellite export-import centers as being subordinate to the central commission for imports and exports in Moscow.

These procurement programs have been reported to be highly secret. It may be noted here, also, that since export controls in the US were installed, the USSR has concentrated on purchasing, through Satellite channels in Western Europe, many commodities other than anti-friction bearings, and has made little or no attempt to break the controls within the US directly through its purchasing agents.

It must be noted that the pattern of indirect purchases and shipments to Eastern Europe, which is in addition to direct shipments by producing countries, adds up to an unknown but very large quantity of total imports by Eastern Europe.

PROBLEMS OF ADMINISTRATIVE CONTROLS

A. Stockpiling and "Normal" Requirements.

"Excessive levels" of Soviet orbit imports of anti-friction bearings cannot be accurately estimated for the following reasons:

1. One factor affecting requirements is the difference between normal stock inventory practices and strategic stockpiling purposes. Requirements for normal stock inventory practices vary by the country and economic system. The Soviet is probably unique in its strategic stockpiling practices since such stockpiling receives priority over normal stock inventory practices.

2. There are also several variables in replacement needs which condition a country's requirements. During the postwar period, extraordinary replacement needs in consequences of excessive wartime deterioration of such equipment in normal industrial and peacetime equipment were evident in several Western European countries. In addition, deterioration, resulting from low maintainance standards and careless use within the Soviet Bloc would probably be serveral times more than normal replacement needs under Western European practices.

3. Requirements should also be defined, particularly for Eastern Europe, in terms of industrial expansion. Planned expansion is considerably at variance with real expansion. An expansion would necessitate an increased need for anti-friction bearings, but the degree of such expansion is still to be determined.

4. The fact that no one country manufactures all sizes and types, further affects the imports of bearings. Even such major producers as Sweden require the importation of certain bearing types not manufactured domestically. In addition, the bearing industry varies by countries in the need for special steels and steel shapes, as well as component parts.

5. Prewar imports have, heretofore, been used as a rule-of-thumb guide in some instances of export control. Bearing production, however, has been expanded since the prewar era, and new production has been inaugurated in countries heretofore not producing bearings. These factors, plus the increase of production within the Soviet Bloc in the postwar years, would necessarily distort any requirement level based on prewar imports.

6. In US exports of anti-friction bearings to European countries, a minor factor is the supply of replacement parts by US equipment and automotive manufacturers. With the dumping of surplus US supplies throughout the world, and the expansion of markets overseas since the end of the war, US manufacturers

have been exporting bearings for the supply of replacements overseas in equipment of US origin. In so doing they have been declaring these bearings as component parts or as subassemblies, rather than as exported bearings.

7. Even though a level is established on the basis of an Eastern European urgent or "minimum consumption rate", as noted previously in this report, Eastern Europe can still stockpile for war use to the detriment of several branches of the economy. Even a few bearings exported under limited export control might be detrimental to the national security of the US.

B. Definition of "Precision" Bearings.

There is no definition of "precision" bearings which would be adequate for administrative procedures. Close tolerances may be defined for any one of a number of surfaces, radii, and diameters for any one particular bearing.

Although "precision" has a special meaning among manufacturers of bearings, and to some consumers (such as aircraft and instrument builders), almost the entire field of commercial bearings manufactured in the US, Sweden, UK, and Switzerland are held to close tolerances for commercial use. A very small catagory of assembled bearings—such as casters, stamped bearings, and unground steel balls—do not come within the definition of "precision" bearings.

C. Control by Specifications.

Although the foregoing indicates certain brackets of series numbers which have a predominately military end-use, it is generally rarely possible to ascribe exclusive military end-use to any particular categories with the exception of a few aircraft and accessory series numbers. During the past war the pattern of wartime manufacture of anti-friction bearings in the US differed not so much in the specific change in specifications manufactured, but in the quantities of certain categories. Therefore, bearing manufacturers faced with a change from war production to peacetime production, or vice-versa, had a very real conversion problem. The problem was not so much one of development and manufacture of a few specific bearings as it was mass production of certain bearings required in great quantity during wartime.

It is possible, however, that specifications for war material in the US are considerably more rigid than those used within the Soviet Orbit. If so, Soviet Orbit war material requirements can be expected to be more flexible, allowing for greater substitution and interchangeability of anti-friction bearing requirements. For example, certain types of roller bearings can be substituted for ball-bearing uses, and although the performance will not yield as great an efficiency, the difference is only relative. The highly developed German anti-friction bearing industry, facing the problem of a wide range of specifications, concluded, theoretically, that it might be possible to reduce the range from any thousands of types and sizes to a minimum of 2000. (The German industry, however, never found it practical to attempt to implement this theory.)

Administrative controls of bearings by specification are further complicated by the lack of world-wide uniformity in bearing numbers. Within the US, bearing numbers carry individual manufacturers' catalogue numbers; and though, generally speaking, a majority can be translated into SKF catalogue numbers, there are many problems that have to be met in standardizing one complete catalogue of all bearing numbers manufactured in the US. European catalogue numbers are also individually trademarked by each manufacturer. Thus the RIV (Italian) numbering system is not the same as Swedish SKF, nor US manufacturers' catalogue numbers. Swiss manufacturers systems are entirely unlike Italian and International SKF numbers. The same is true of individual French manufacturers, hence any overall control by numbers would present an enormously complicated problem of standardizing all manufacturers' series numbers.

Inasmuch as anti-friction bearings do not constitute bulky or conspicuous shipments, the simple problem of controlling bearings, as such, would be the first item to study before the problem of individual series numbers could be undertaken.

D. Control by Size Range.

As a possible alternative to 100% control of exports, a compromise might be effected with producer countries by the establishment of a size range of bearings which would be subject to control.

Sizes smaller than 20 millimeter bore are commonly used in instruments, while sizes larger than 50 millimeter bore are used in trucks, tanks, self-propelled gun mounts, aircraft engines, and in industry generally connected with munitions production. Bearings beyond the range listed are of the greatest importance in building a war potential, although practically all sizes are used in military material.

Bearings of commercial quality, ranging in bore sizes from a minimum of 20 millimeters to a maximum of 50 millimeters, in all types (single row, double row, thrust, angular contact ball bearings, tapered and straight roller bearings, and needle bearings as well as automobile front wheel and clutch-throw-out bearings) would be the only sizes free of export controls. Sizes below or above this range of bore sizes, including all bearings of unusual tolerances or special nature would be controlled.

It is pointed out that the sizes that would not be controlled would include the majority of those normally exported for non-military peacetime use. It is true that many of these same sizes are being used for military applications. From an exporter's point of view there should be no objections, since such limited control should result in an ample volume of export business.

E. Control by Bearing Components.

In order to exert effective bearing control over a number of years, it would be necessary to make a close study of the export and import of steel, bronze, and other metals used in bearings; of component bearing parts (balls, inner and outer rings, and retainers); and also of the machine tools required for mass production of bearings.

Anti-friction bearings are made of special alloy steels, and mass production manufacture is a highly specialized machining problem. The Soviet Orbit imports not only finished bearing units, but also considerable quantities of specialized anti-friction bearing steels. Although Sweden is a large exporter of this commodity (and Swedish trade agreements report it separately), other manufacturing countries are assumed to be shipping the same types of steel, but within a general category not specifying anti-friction bearing steels.

The Soviet Orbit is also importing component parts, such as steel balls. Western manufacturing countries have been exporting critical component parts which are not reported as assembled bearing units.